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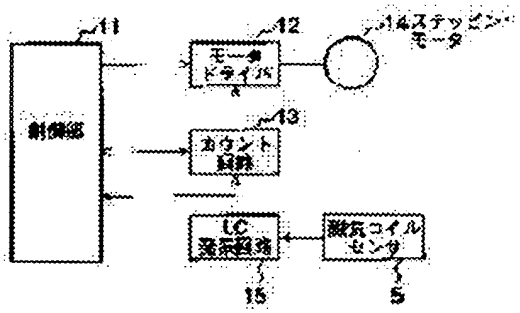
(54) METHOD FOR DISCRIMINATING KIND OF PRINTING SHEET IN SERIAL PRINTER

(57)Abstract:

PROBLEM TO BE SOLVED: To discriminate the kind of a printing sheet correctly by judging the kind of the printing sheet by judging whether the difference in the approach quantity of a print head is more than or equal to a prescribed value or not when the change quantity of pulse frequency associated with the change of the distance of a pair of magnetic substances exceeds the first and second standard values by the approach to a printing sheet.

SOLUTION: During non-printing, the distance between a magnetic coil sensor 5 and a magnetic piece is kept constant, the pulse frequency from an LC oscillating circuit 15 connected to the sensor 5 changes when a ribbon protector contacts a printing sheet. A count circuit 13 counts the pulse from the circuit 15 and outputs the count value to a control part 11. The control part 11 compares the value with a standard value and judges whether the difference is a prescribed value or not, and judges whether the change quantity of the pulse frequency exceeds the first and second standard values. When the quantity exceeds both standard values, the difference in the approach quantity of a print head at that time is calculated, and the kind of the printing sheet is judged by judging whether the difference is more than or equal to a prescribed valued or not.



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CLAIMS

[Claim(s)]
[Claim 1] In the approach of distinguishing the class of print form inserted between the print head and the platen Spacing of the magnetic substance of a pair changes with approach with a print head and a print form. The inductance output outputted from the magnetic substance of the pair is changed into a pulse output. It judges whether the variation of the frequency of a pulse exceeded the 1st reference value by approach with a print head and a print form. The amount of approach of the print head when exceeding, when it judges with having exceeded is memorized. It judges whether when the variation of a pulse frequency exceeded said 1st reference value, the variation of a pulse frequency exceeded the 2nd reference value. The amount of approach of the print head when exceeding, when it judges with having exceeded is memorized. By whether there is any difference with the amount of approach of a print head when the amount of approach of a print head when the variation of a pulse frequency exceeds said 1st reference value, and the variation of a pulse frequency exceed said 2nd reference value more than predetermined The print form class distinction approach in the serial printer characterized by distinguishing the class of print form.
[Claim 2] The amount of approach of a print head when the amount of approach of a print head when the variation of said pulse frequency exceeds said 1st reference value, and the variation of said pulse frequency exceed said 1st reference value is the print form class distinction approach in the serial printer according to claim 1 computed by counting a clock from the time of a pulse frequency beginning to change.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach of distinguishing especially single paper and tracing paper about the approach of judging the class of print form in the serial printer which has an automatic thickness-of-paper detection sensor.
[0002]
[Description of the Prior Art] When the ferrite core of the ferromagnetic of a pair is prepared near a print head and spacing of a print head and a print form is conventionally changed as the automatic thickness-of-paper detection approach of detecting the thickness of a print form automatically, there are some into which the ferrite core of a pair also changed mutual spacing along with it. By this approach, a coil is given to ferrite core of one of the two, and pulse conversion of the inductance change according to the distance between ferrite cores is carried out using LC oscillator circuit. If spacing of a print head and a print form is shortened and a print head comes to contact a print form, the frequency of the pulse outputted from LC oscillator circuit will change. When change of the frequency of a pulse exceeds a constant rate, it judges that the print head ran against the print form, the location to a specified quantity print head is pulled apart from a form, and spacing of a print head and a form is fixed.
[0003] Moreover, although the set print form had to distinguish single paper or tracing paper since printing speed usually had to be made later than printing speed when a print form was tracing paper, detection of thickness of paper was performing this distinction

conventionally. That is, if the thickness of paper detected by automatic thickness-of-paper detection was below criteria thickness, it was judged as single paper, and when it was more than criteria thickness, it was judged as tracing paper. When it is judged as single paper, printing speed is usually set as a rate, and when it was judged as tracing paper, it is made printing speed usually later than a rate, and he raises the impact force, and was trying to print.

[0004]

[Problem(s) to be Solved by the Invention] However, by the distinction approach of the above-mentioned conventional print form class, since thickness of paper is performing distinction of single paper and tracing paper, the single paper of thickness will also be distinguished from tracing paper more than the criteria thickness of distinction. And since it printed at the rate usually later than printing speed in spite of single paper, there was a problem that improvement in a throughput could not be aimed at.

[0005]

[Means for Solving the Problem] In the approach of distinguishing the class of print form with which this invention was inserted between the print head and the platen in order to solve the above-mentioned technical problem Spacing of the magnetic substance of a pair changes with approach with a print head and a print form. The inductance output outputted from the magnetic substance of the pair is changed into a pulse output. It judges whether the variation of the frequency of a pulse exceeded the 1st reference value by approach with a print head and a print form. The amount of approach of the print head when exceeding, when it judges with having exceeded is memorized. It judges whether when the variation of a pulse frequency exceeded said 1st reference value, the variation of a pulse frequency exceeded the 2nd reference value. The amount of approach of the print head when exceeding, when it judges with having exceeded is memorized. It is characterized by distinguishing the class of print form by whether there is any difference with the amount of approach of a print head when the amount of approach of a print head when the variation of a pulse frequency exceeds said 1st reference value, and the variation of a pulse frequency exceed said 2nd reference value more than predetermined.

[0006] According to this invention which has the above-mentioned configuration, it judges whether the 1st reference value and the 2nd larger reference value than this were exceeded for the variation of the pulse frequency by approach with a print head and a print form. When both reference values are exceeded, the difference of the amount of approach of the print head at the time of exceeding the reference value of the both is computed, and the class of print form is distinguished by whether there is the difference more than predetermined.

[0007]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained according to a drawing. In addition, the same sign is given to the element common to each drawing. The flow chart with which drawing 1 shows actuation of the gestalt of operation of this invention, the explanatory view in which drawing 2 shows the automatic thickness-of-paper detection device of the gestalt of operation, and drawing 3 are the block diagrams showing the gestalt of operation. Drawing 2 explains the automatic thickness-of-paper detection device of the gestalt of operation first.

[0008] In drawing 2 , the print head 1 which prints is carried in carriage 2, and carriage 2 is ****(ed) by the shaft 3 possible [sliding]. The shaft 3 is pivotable with the stepping motor mentioned later, and when a shaft 3 rotates, a print head 1 is approached or isolated to a platen 4. The magnet coil sensor 5 fixes on carriage 2, and the ribbon protector 6 is attached in the lower part. The magnetic piece 8 is being fixed to the ribbon protector 6

through the attachment member 7. Spacing of the magnet coil sensor 5 and the magnetic piece 8 is kept constant at the time (condition of not being equipped with the print form) of un-printing. It is equipped with a print form 9 between the ribbon protector 6 and a platen 4.

[0009] In drawing 3 , a control section 11 controls the whole actuation of a printer, is constituted by the microcomputer etc., and has the memory storage function, the calculation function, and the comparison function. Motor Driver 12 and a counter circuit 13 are connected to the control section 11. Motor Driver 12 drives a stepping motor 14 by the command of a control section 11. A stepping motor 14 is a motor made to rotate the shaft 3 shown in drawing 2 . The count circuit 13 is connected to the LC oscillator circuit 15, and the LC oscillator circuit 15 is connected to the magnet coil sensor 5. The LC oscillator circuit 15 is a circuit which changes the inductance output of the magnet coil sensor 5 into a pulse, and is outputted to the count circuit 13.

[0010] Drawing 4 is the block diagram showing the detail of the counter circuit of the gestalt of operation. A counter circuit 13 is constituted by two timer counters 13a and 13b in this drawing. Timer counter 13a makes the time amount which carries out the sample of the pulse outputted from the phase change period and the LC oscillator circuit 15 of the stepping motor 14 which makes a print head 1 approach in the platen 4 direction, and clock signal CLK-P is inputted into a gate (GATE1) terminal again at the clock (CLK) terminal of this timer counter 13a, respectively from the control section 11 which gate signal GATE-P shows as a control signal at drawing 3 . Moreover, signal IPT-P outputted from the output (OUT) terminal of timer counter 13a is inputted into Motor Driver 12 and timer counter 13b through an inverter 16.

[0011] Timer counter 13b counts the pulse outputted from the LC oscillator circuit 15, and signal IPT-P outputted from timer counter 13a inputs it into a gate (GATE2) terminal. This timer counter 13b is connected to the control section 11 shown in drawing 3 , and the count result of timer counter 13b is outputted to a control section 11. Both the timer counters 13a and 13b can set counted value as arbitration, and an output (OUT) terminal is set to "0" at the same time a gate terminal is "1" and it starts a count, and they use it in the mode in which an output terminal changes from "0" to "1" by count termination.

[0012] Next, actuation of the gestalt of this operation is mainly explained according to the flow chart of drawing 1 , and the timing chart of drawing 5 . Drawing 5 is a timing chart which shows actuation of a counter circuit. In addition, the signal of a-e shown in drawing 4 shows the wave of (a) - (e) shown in drawing 5 R> 5.

[0013] The frequency of the pulse outputted from the LC oscillator circuit 15 does not change until the ribbon protector 6 contacts a print form 9, but if the ribbon protector 6 contacts a print form 9, it will change. The frequency of the pulse before changing is set to f, and this value f is beforehand memorized to the control section 11.

[0014] It is equipped with a print form 9 between the ribbon protector 6 and a platen 4, and a control section 11 will drive a stepping motor 14, if a command is taken out to Motor Driver 12. The shaft 3 which this shows to drawing 2 rotates, and carriage 2 begins to approach a print form 9.

[0015] As shown in drawing 5 (a), clock signal CLK-P is inputted into timer counter 13a. A control section 11 sets "1" to the gate terminal of timer counter 13a, as Tm is set to timer counter 13a as sampling time (step 1) and it is shown in drawing 5 (b) (step 2). The sampling time Tm set to timer counter 13a is the phase change period of a stepping motor 14. By setting "1" to a gate terminal, timer counter 13a starts a count and output signal IPT-P of timer counter 13a is set to "0" (drawing 5 (c)). When output signal IPT-P of

timer counter 13a is set to "0", the gate terminal of timer counter 13b opens (drawing 5 (d)), and timer counter 13b starts the count of the pulse (drawing 5 (e)) which the LC oscillator circuit 15 outputs.

[0016] After timer counter 13a ends a count, the output signal IPT-P changes to "1" from "0" (step 3), and the gate signal of timer counter 13b changes from "1" to "0" (step 4). This also ends count actuation of timer counter 13b. The counted value fm counted by timer counter 13b is sent to a control section 11. Next, the gate signal (GATE-P) of timer counter 13a is set to "0", and the mask of the clock signal (CLK-P) input of timer counter 13a is carried out.

[0017] In a control section 11, it judges whether as compared with the reference value f memorized beforehand, the difference (fm-f) serves as the predetermined value deltafl about the received counted value fm (step 5). A reference value f is the frequency of the pulse before changing as mentioned above, and the predetermined value deltafl is variation of a frequency which detects the changing point of the pulse frequency from the LC oscillator circuit 15, and is beforehand memorized by the control section 11 here. Drawing 6 explains this.

[0018] Drawing 6 is a graph which shows the relation between the frequency of the pulse outputted from the LC oscillator circuit 15, and the amount of approach to the platen of a print head, an axis of ordinate shows a frequency and an axis of abscissa shows the amount of approach to a platen. Moreover, a continuous line shows the case of tracing paper and a dotted line shows the case of single paper. Here, the thing of the thickness same as tracing paper and single paper is used. (It says that the thickness in the condition of having forced tracing paper 9a as the still more nearly same thickness as shown in drawing 7 , and having lost the middle opening 18 is equal to the thickness of single paper 9b.) Drawing 7 is the explanatory view showing the forcing condition of a print form. A frequency does not change until the ribbon protector 6 contacts [in tracing paper] a form also in single paper. However, when tracing paper 9a is compared with single paper 9b, as for the ribbon protector 6 contacting a form, the direction of tracing paper 9a contacts previously. This has the thickness thicker than single paper before there being an opening in the middle of tracing paper 9a, for this reason pushing, and the ribbon protector 6 contacts a little early. Therefore, as for change of a frequency, the direction of tracing paper appears ahead of single paper so that it may see to drawing 6 . The predetermined value deltafl is set as the any value of the phase where a frequency began to change. In the example of drawing 6 , in the case of tracing paper, it is A1 point to become the predetermined value deltafl, and, in the case of single paper, it becomes A2 point.

[0019] In step 5, if the difference of counted value fm and a reference value f does not become the predetermined value deltafl, the phase change of a stepping motor 14 will be performed (step 6), and the counted value of timer counter 13b will be cleared (step 7). And the actuation which starts a timer counter return and the stepping motor phase change period Tm to step 1 is repeated.

[0020] When the difference of counted value fm and a reference value f becomes the predetermined value deltafl, a control section 11 memorizes the changing point (A1, A2 point shown in drawing 6) of a frequency (step 8). This A1 and an A2 point location are pinpointed by counting a clock with the counter which is not illustrated for example, in a control section 11. And a control section 11 sets the stepping motor phase change period Tm to timer counter 13a as sampling time (step 9), and clears timer counter 13b (step 10). Moreover, the phase change of a stepping motor 14 is performed (step 11), "1" of the gate terminal of timer counter 13a is set (step 12), and timer counters 13a and 13b are started.

Thereby, timer counter 13b counts the pulse frequency in a period Tm.
[0021] After timer counter 13a ends a count, the output signal IPT-P changes to "1" from "0" (step 13), and the gate signal of timer counter 13b changes from "1" to "0" (step 14). This also ends count actuation of timer counter 13b. The counted value fm counted by timer counter 13b is sent to a control section 11. Next, the gate signal (GATE-P) of timer counter 13a is set to "0", and the mask of the clock signal (CLK-P) input of timer counter 13a is carried out.
[0022] In a control section 11, it judges whether as compared with the reference value f memorized beforehand, the difference (fm-f) serves as the predetermined value deltaf2 about the received counted value fm (step 15). The predetermined value deltaf2 is variation of a frequency which detects the condition that tracing paper 9a was forced and the opening was completely lost, and as shown in drawing 6 , it has relation of deltaf2>deltaf1 here. This predetermined value deltaf2 is made to have memorized in a control section 11 beforehand.
[0023] When the difference of counted value fm and a reference value f is not set to deltaf2, count actuation is repeated until the difference of return, counted value fm, and a reference value f is set to deltaf2 to step 9. When the difference of counted value fm and a reference value f is set to deltaf2, the changing point (B point) of the frequency at that time is memorized to a control section 11 (step 16). The case of tracing paper, and in the case of single paper, it is the same, and is made to make a B point memorize in a control section 11 as counted value, as this changing point B point is shown in drawing 6 R> 6.
[0024] Next, a control section 11 computes a difference (C=B-A) with the value of the B point memorized at the value and step 16 of the A point memorized at step 8 (step 17). In tracing paper 9a, the difference C1 is computed by B-A1, and, in the case of single paper, the difference C2 is computed by B-A2 here. And the computed value judges whether it is larger than a certain reference value n or small (step 18). A reference value n is a value for distinguishing tracing paper 9a and single paper 9b, and is set as the middle value of C1 and C2 shown in drawing 6 here. This reference value n is beforehand memorized by the control section 11. When the difference of the value of an A point and the value of a B point is larger than n, it distinguishes that it is tracing paper, and when small, it distinguishes from single paper (steps 19 and 20).
[0025] When a control section 11 sets the printing speed according to tracing paper, and head drive time amount when it distinguishes from tracing paper (step 21), and it distinguishes from single paper, a control section 11 sets usual printing speed and head drive time amount (step 22). Distinction actuation of tracing paper and single paper is ended by the above.
[0026] In addition, although sampling time Tm counted by timer counter 13a was made into the phase change period of a stepping motor 14 with the gestalt of the above-mentioned implementation, it is not necessary to necessarily make sampling time Tm into this phase change period. However, there is effectiveness which can perform saving of a circuit and control by making sampling time Tm into the phase change period of a stepping motor 14.
[0027]
[Effect of the Invention] Since a print form becomes possible [distinguishing whether it is tracing paper and whether it is single paper] by detecting change of the frequency of the pulse outputted from an automatic thickness-of-paper detection device according to this invention as explained to the detail above, and it becomes possible to distinguish it from single paper even if single paper is pasteboard, and to usually print at a rate, improvement in the throughput of printing can be aimed at.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the approach of distinguishing especially single paper and tracing paper about the approach of judging the class of print form in the serial printer which has an automatic thickness-of-paper detection sensor.

PRIOR ART

[Description of the Prior Art] When the ferrite core of the ferromagnetic of a pair is prepared near a print head and spacing of a print head and a print form is conventionally changed as the automatic thickness-of-paper detection approach of detecting the thickness of a print form automatically, there are some into which the ferrite core of a pair also changed mutual spacing along with it. By this approach, a coil is given to ferrite core of one of the two, and pulse conversion of the inductance change according to the distance between ferrite cores is carried out using LC oscillator circuit. If spacing of a print head and a print form is shortened and a print head comes to contact a print form, the frequency of the pulse outputted from LC oscillator circuit will change. When change of the frequency of a pulse exceeds a constant rate, it judges that the print head ran against the print form, the location to a specified quantity print head is pulled apart from a form, and spacing of a print head and a form is fixed.
[0003] Moreover, although the set print form had to distinguish single paper or tracing paper since printing speed usually had to be made later than printing speed when a print form was tracing paper, detection of thickness of paper was performing this distinction conventionally. That is, if the thickness of paper detected by automatic thickness-of-paper detection was below criteria thickness, it was judged as single paper, and when it was more than criteria thickness, it was judged as tracing paper. When it is judged as single paper, printing speed is usually set as a rate, and when it was judged as tracing paper, it is made printing speed usually later than a rate, and he raises the impact force, and was trying to print.

EFFECT OF THE INVENTION

[Effect of the Invention] Since a print form becomes possible [distinguishing whether it is tracing paper and whether it is single paper] by detecting change of the frequency of the pulse outputted from an automatic thickness-of-paper detection device according to this invention as explained to the detail above, and it becomes possible to distinguish it from single paper even if single paper is pasteboard, and to usually print at a rate, improvement in the throughput of printing can be aimed at.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, by the distinction approach of the above-mentioned conventional print form class, since thickness of paper is performing distinction of single paper and tracing paper, the single paper of thickness will also be distinguished from tracing paper more than the criteria thickness of distinction. And since it printed at the rate usually later than printing speed in spite of single paper, there was a problem that improvement in a throughput could not be aimed at.

MEANS

[Means for Solving the Problem] In the approach of distinguishing the class of print form with which this invention was inserted between the print head and the platen in order to solve the above-mentioned technical problem Spacing of the magnetic substance of a pair changes with approach with a print head and a print form. The inductance output outputted from the magnetic substance of the pair is changed into a pulse output. It judges whether the variation of the frequency of a pulse exceeded the 1st reference value by approach with a print head and a print form. The amount of approach of the print head when exceeding, when it judges with having exceeded is memorized. It judges whether when the variation of a pulse frequency exceeded said 1st reference value, the variation of a pulse frequency exceeded the 2nd reference value. The amount of approach of the print head when exceeding, when it judges with having exceeded is memorized. It is characterized by distinguishing the class of print form by whether there is any difference with the amount of approach of a print head when the amount of approach of a print head when the variation of a pulse frequency exceeds said 1st reference value, and the variation of a pulse frequency exceed said 2nd reference value more than predetermined.
[0006] According to this invention which has the above-mentioned configuration, it judges whether the 1st reference value and the 2nd larger reference value than this were exceeded for the variation of the pulse frequency by approach with a print head and a print form. When both reference values are exceeded, the difference of the amount of approach of the print head at the time of exceeding the reference value of the both is computed, and the class of print form is distinguished by whether there is the difference more than predetermined.
[0007]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained according to a drawing. In addition, the same sign is given to the element common to each drawing. The flow chart with which drawing 1 shows actuation of the gestalt of operation of this invention, the explanatory view in which drawing 2 shows the automatic thickness-of-paper detection device of the gestalt of operation, and drawing 3 are the block diagrams showing the gestalt of operation. Drawing 2 explains the automatic thickness-of-paper detection device of the gestalt of operation first.
[0008] In drawing 2 , the print head 1 which prints is carried in carriage 2, and carriage 2 is ****(ed) by the shaft 3 possible [sliding]. The shaft 3 is pivotable with the stepping motor mentioned later, and when a shaft 3 rotates, a print head 1 is approached or isolated to a platen 4. The magnet coil sensor 5 fixes on carriage 2, and the ribbon protector 6 is attached in the lower part. The magnetic piece 8 is being fixed to the ribbon protector 6 through the attachment member 7. Spacing of the magnet coil sensor 5 and the magnetic piece 8 is kept constant at the time (condition of not being equipped with the print form) of un-printing. It is equipped with a print form 9 between the ribbon protector 6 and a platen 4.
[0009] In drawing 3 , a control section 11 controls the whole actuation of a printer, is constituted by the microcomputer etc., and has the memory storage function, the calculation function, and the comparison function. Motor Driver 12 and a counter circuit 13 are connected to the control section 11. Motor Driver 12 drives a stepping motor 14 by the command of a control section 11. A stepping motor 14 is a motor made to rotate the shaft 3 shown in drawing 2 . The count circuit 13 is connected to the LC oscillator circuit 15, and the LC oscillator circuit 15 is connected to the magnet coil sensor 5. The LC oscillator circuit 15 is a circuit which changes the inductance output of the magnet coil

sensor 5 into a pulse, and is outputted to the count circuit 13.
[0010] Drawing 4 is the block diagram showing the detail of the counter circuit of the gestalt of operation. A counter circuit 13 is constituted by two timer counters 13a and 13b in this drawing. Timer counter 13a makes the time amount which carries out the sample of the pulse outputted from the phase change period and the LC oscillator circuit 15 of the stepping motor 14 which makes a print head 1 approach in the platen 4 direction, and clock signal CLK-P is inputted into a gate (GATE1) terminal again at the clock (CLK) terminal of this timer counter 13a, respectively from the control section 11 which gate signal GATE-P shows as a control signal at drawing 3 . Moreover, signal IPT-P outputted from the output (OUT) terminal of timer counter 13a is inputted into Motor Driver 12 and timer counter 13b through an inverter 16.
[0011] Timer counter 13b counts the pulse outputted from the LC oscillator circuit 15, and signal IPT-P outputted from timer counter 13a inputs it into a gate (GATE2) terminal. This timer counter 13b is connected to the control section 11 shown in drawing 3 , and the count result of timer counter 13b is outputted to a control section 11. Both the timer counters 13a and 13b can set counted value as arbitration, and an output (OUT) terminal is set to "0" at the same time a gate terminal is "1" and it starts a count, and they use it in the mode in which an output terminal changes from "0" to "1" by count termination.
[0012] Next, actuation of the gestalt of this operation is mainly explained according to the flow chart of drawing 1 , and the timing chart of drawing 5 . Drawing 5 is a timing chart which shows actuation of a counter circuit. In addition, the signal of a-e shown in drawing 4 shows the wave of (a) - (e) shown in drawing 5 R> 5.
[0013] The frequency of the pulse outputted from the LC oscillator circuit 15 does not change until the ribbon protector 6 contacts a print form 9, but if the ribbon protector 6 contacts a print form 9, it will change. The frequency of the pulse before changing is set to f, and this value f is beforehand memorized to the control section 11.
[0014] It is equipped with a print form 9 between the ribbon protector 6 and a platen 4, and a control section 11 will drive a stepping motor 14, if a command is taken out to Motor Driver 12. The shaft 3 which this shows to drawing 2 rotates, and carriage 2 begins to approach a print form 9.
[0015] As shown in drawing 5 (a), clock signal CLK-P is inputted into timer counter 13a. A control section 11 sets "1" to the gate terminal of timer counter 13a, as Tm is set to timer counter 13a as sampling time (step 1) and it is shown in drawing 5 (b) (step 2). The sampling time Tm set to timer counter 13a is the phase change period of a stepping motor 14. By setting "1" to a gate terminal, timer counter 13a starts a count and output signal IPT-P of timer counter 13a is set to "0" (drawing 5 (c)). When output signal IPT-P of timer counter 13a is set to "0", the gate terminal of timer counter 13b opens (drawing 5 (d)), and timer counter 13b starts the count of the pulse (drawing 5 (e)) which the LC oscillator circuit 15 outputs.
[0016] After timer counter 13a ends a count, the output signal IPT-P changes to "1" from "0" (step 3), and the gate signal of timer counter 13b changes from "1" to "0" (step 4). This also ends count actuation of timer counter 13b. The counted value fm counted by timer counter 13b is sent to a control section 11. Next, the gate signal (GATE-P) of timer counter 13a is set to "0", and the mask of the clock signal (CLK-P) input of timer counter 13a is carried out.
[0017] In a control section 11, it judges whether as compared with the reference value f memorized beforehand, the difference (fm-f) serves as the predetermined value deltaf1 about the received counted value fm (step 5). A reference value f is the frequency of the

pulse before changing as mentioned above, and the predetermined value deltaf1 is variation of a frequency which detects the changing point of the pulse frequency from the LC oscillator circuit 15, and is beforehand memorized by the control section 11 here. Drawing 6 explains this.

[0018] Drawing 6 is a graph which shows the relation between the frequency of the pulse outputted from the LC oscillator circuit 15, and the amount of approach to the platen of a print head, an axis of ordinate shows a frequency and an axis of abscissa shows the amount of approach to a platen. Moreover, a continuous line shows the case of tracing paper and a dotted line shows the case of single paper. Here, the thing of the thickness same as tracing paper and single paper is used. (It says that the thickness in the condition of having forced tracing paper 9a as the still more nearly same thickness as shown in drawing 7 , and having lost the middle opening 18 is equal to the thickness of single paper 9b.) Drawing 7 is the explanatory view showing the forcing condition of a print form. A frequency does not change until the ribbon protector 6 contacts [in tracing paper] a form also in single paper. However, when tracing paper 9a is compared with single paper 9b, as for the ribbon protector 6 contacting a form, the direction of tracing paper 9a contacts previously. This has the thickness thicker than single paper before there being an opening in the middle of tracing paper 9a, for this reason pushing, and the ribbon protector 6 contacts a little early. Therefore, as for change of a frequency, the direction of tracing paper appears ahead of single paper so that it may see to drawing 6 . The predetermined value deltaf1 is set as the any value of the phase where a frequency began to change. In the example of drawing 6 , in the case of tracing paper, it is A1 point to become the predetermined value deltaf1, and, in the case of single paper, it becomes A2 point.

[0019] In step 5, if the difference of counted value fm and a reference value f does not become the predetermined value deltaf1, the phase change of a stepping motor 14 will be performed (step 6), and the counted value of timer counter 13b will be cleared (step 7). And the actuation which starts a timer counter return and the stepping motor phase change period Tm to step 1 is repeated.

[0020] When the difference of counted value fm and a reference value f becomes the predetermined value deltaf1, a control section 11 memorizes the changing point (A1, A2 point shown in drawing 6) of a frequency (step 8). This A1 and an A2 point location are pinpointed by counting a clock with the counter which is not illustrated for example, in a control section 11. And a control section 11 sets the stepping motor phase change period Tm to timer counter 13a as sampling time (step 9), and clears timer counter 13b (step 10). Moreover, the phase change of a stepping motor 14 is performed (step 11), "1" of the gate terminal of timer counter 13a is set (step 12), and timer counters 13a and 13b are started. Thereby, timer counter 13b counts the pulse frequency in a period Tm.

[0021] After timer counter 13a ends a count, the output signal IPT-P changes to "1" from "0" (step 13), and the gate signal of timer counter 13b changes from "1" to "0" (step 14). This also ends count actuation of timer counter 13b. The counted value fm counted by timer counter 13b is sent to a control section 11. Next, the gate signal (GATE-P) of timer counter 13a is set to "0", and the mask of the clock signal (CLK-P) input of timer counter 13a is carried out.

[0022] In a control section 11, it judges whether as compared with the reference value f memorized beforehand, the difference (fm-f) serves as the predetermined value deltaf2 about the received counted value fm (step 15). The predetermined value deltaf2 is variation of a frequency which detects the condition that tracing paper 9a was forced and the opening was completely lost, and as shown in drawing 6 , it has relation of

deltaf2>deltaf1 here. This predetermined value deltaf2 is made to have memorized in a control section 11 beforehand.
[0023] When the difference of counted value fm and a reference value f is not set to deltaf2, count actuation is repeated until the difference of return, counted value fm, and a reference value f is set to deltaf2 to step 9. When the difference of counted value fm and a reference value f is set to deltaf2, the changing point (B point) of the frequency at that time is memorized to a control section 11 (step 16). The case of tracing paper, and in the case of single paper, it is the same, and is made to make a B point memorize in a control section 11 as counted value, as this changing point B point is shown in drawing 6 R> 6.
[0024] Next, a control section 11 computes a difference (C=B-A) with the value of the B point memorized at the value and step 16 of the A point memorized at step 8 (step 17). In tracing paper 9a, the difference C1 is computed by B-A1, and, in the case of single paper, the difference C2 is computed by B-A2 here. And the computed value judges whether it is larger than a certain reference value n or small (step 18). A reference value n is a value for distinguishing tracing paper 9a and single paper 9b, and is set as the middle value of C1 and C2 shown in drawing 6 here. This reference value n is beforehand memorized by the control section 11. When the difference of the value of an A point and the value of a B point is larger than n, it distinguishes that it is tracing paper, and when small, it distinguishes from single paper (steps 19 and 20).
[0025] When a control section 11 sets the printing speed according to tracing paper, and head drive time amount when it distinguishes from tracing paper (step 21), and it distinguishes from single paper, a control section 11 sets usual printing speed and head drive time amount (step 22). Distinction actuation of tracing paper and single paper is ended by the above.
[0026] In addition, although sampling time Tm counted by timer counter 13a was made into the phase change period of a stepping motor 14 with the gestalt of the above-mentioned implementation, it is not necessary to necessarily make sampling time Tm into this phase change period. However, there is effectiveness which can perform saving of a circuit and control by making sampling time Tm into the phase change period of a stepping motor 14.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the flow chart which shows actuation of the gestalt of operation of this invention.
[Drawing 2] It is the explanatory view showing the automatic thickness-of-paper detection device of the gestalt of operation.
[Drawing 3] It is the block diagram showing the gestalt of operation.
[Drawing 4] It is the block diagram showing the counter circuit of the gestalt of operation.
[Drawing 5] It is the timing chart which shows actuation of a counter circuit.
[Drawing 6] It is the graph which shows the relation between a frequency and the amount of approach to a platen.
[Drawing 7] It is the explanatory view showing the forcing condition of a print form.
[Description of Notations]
1 Print Head
4 Platen
5 Magnet Coil Sensor

6 Ribbon Protector
9 Print Form
11 Control Section
13 Count Circuit
13a, 13b Timer counter
14 Stepping Motor
15 LC Oscillator Circuit